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**SAVINGS POSSIBLE BY MARKETING STANDARD  
CHRYSANTHEMUMS IN THE BUD STAGE**

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2001

# SAVINGS POSSIBLE BY MARKETING STANDARD CHRYSANTHEMUMS IN THE BUD STAGE //

2501  
by Arnold L. Lundquist and Robert C. Mongelli<sup>1</sup>

## SUMMARY

Research was performed to determine the advantages and disadvantages in cutting and shipping standard chrysanthemums (mums) in the bud stage. The flower is currently cut from the plant and shipped only after it is in full bloom. Handling and transporting mums in the bud stage to points in Eastern United States would result in estimated savings, per 1,000 flowers shipped, of about \$29 by air from California, and about \$31 by truck and \$32 by air from Florida. Savings for approximately 67 million mums shipped from California and Florida in 1969 would be about \$1.9 million.

Data were obtained from experimental shipments of buds by air from California and by truck and air from Florida to wholesalers and retailers in the Eastern United States. The buds were opened after arrival at destination by placing their stems in a solution of chemically fortified water (floral preservative solution), a technique developed by plant researchers in earlier studies. The buds required up to 6 days to open to full bloom at room temperature (70° to 75° F.).

More buds than open flowers can be packed in a shipping container. For example, a commercial shipping container used by Florida growers held an average of 234 mum buds 2 to 2½ inches in diameter as compared with an

average of 96 fully opened flowers 5½ inches in diameter.

Shipping weight per 1,000 mums was less for buds than for open flowers because buds weigh less and require fewer shipping boxes. Because of these factors, costs for local deliveries (to and from the airports) and for over-the-road truck and air transport were less for buds than for open flowers.

Bud-cut mums, when opened with floral preservative at destination, were equal in size to flowers cut and shipped by the grower in the open stage. Bud mums that were held in refrigerated storage for as long as 2 weeks opened to a commercially usable size when they were placed in opening solution.

Other possible advantages of bud-cut mums include less breakage in handling, less storage space required at grower's and wholesaler's facility, a greater number of mums produced by the grower per plot per year, longer storage at the shipper's or retailer's facility in anticipation of peak demands, longer shelf life after arrival at destination, and lower administrative costs.

Disadvantages with the bud system were the costs for floral preservative, additional space needed, labor to open the buds in solution at the retailer's facility, and the delay before mums are ready for sale.

The study uncovered no major problems in the handling of mums in the bud stage. Minor problems that occur, however, can be corrected more easily if initial shipments of bud-cut mums are handled on a small scale rather than on a large scale.

<sup>1</sup> Marketing specialist and industry economist, respectively, Transportation and Facilities Research Division, Agricultural Research Service, U.S. Department of Agriculture.

## INTRODUCTION

Carnations harvested in the bud stage in California and Colorado have been opened to full bloom with the use of floral preservative after shipment by air to eastern destinations and after being held dry in cold storage for as long as 2 weeks after arrival (2, 3).<sup>2</sup>

These studies on the handling and transporting of carnations in the bud stage, rather than in the full-bloom stage, showed a possible cost saving of \$6.59 per 1,000 flowers. Because carnations and cut mums are handled and transported similarly, it seems promising that substantial savings can be realized if mums are cut and shipped in the bud stage.

Standard chrysanthemums (mums) are grown commercially in all seasons of the year, are always in good demand, lend themselves readily to flower arrangement work, and have a good to excellent keeping quality. In 1969, U.S. growers sold 137 million standard mums with a wholesale value of \$27 million. California was the largest producer, with 71 million mums;

Florida was second, with 10 million mums (7).

Generally, costs for physical handling and transport of a product can be decreased if ways can be found to increase the product's density. Flowers occupy more space for a given weight than many other products do when they are shipped. By shipping mums in the bud stage, a higher density of pack is obtained and the packed weight per 1,000 flowers is reduced. Previous research with bud-cut mums indicated ways in which the density of mums might be increased during shipment (1, 4).

The objective of the research reported here was to assess the potential economies and the advantages and disadvantages of handling and shipping buds. An analysis was made of all steps in handling buds that are different from those in handling open flowers. Seventeen experimental shipments of approximately 5,000 mum buds from California and Florida to eastern wholesale and retail facilities were made over a 2-year period (1969-70).

## BUD SIZE

Much consideration was given to the size of mum bud to use in the experimental shipments. Relatively small buds take less space in the shipping container and, therefore, more of them can be packed per box. Such buds, however, take more time in the preservative to open to salable size. Large buds take more space in the shipping container, but open sooner.

Experiments by personnel of the Market Quality Research Division, Agricultural Research Service, were run to determine the time required to open three sizes of buds to full bloom. The writers ran tests to determine how many of each of these bud sizes could be packed in two sizes of shipping containers. The results are shown in table 1. Because the experiments showed that

more 2- to 2½-inch diameter buds could be packed in a given size box than the other sizes of buds, and they opened to grade size within a reasonable amount of time, this bud size was used in the test shipments.

Table 1.—Opening times for buds of three sizes, and the number of each size packed in two sizes of shipping containers

Bud size		Time to open <sup>1</sup>	Buds packed per box	
			4-foot box <sup>2</sup>	5-foot box <sup>3</sup>
<i>Inches</i>	<i>Millimeters</i>	<i>Days</i>	<i>Number</i>	<i>Number</i>
2 - 2½	50 - 65	5-6	320	360
2¾ - 3¼	70 - 85	4-5	240	280
3½ - 4	90 - 100	2-4	150	185

<sup>2</sup> Italicized numbers in parentheses refer to Literature Cited at the end of the report.

<sup>1</sup> See (6) for details.

<sup>2</sup> 48- by 20- by 12-inch corrugated cardboard container.

<sup>3</sup> 57- by 20- by 12-inch corrugated cardboard container.



## VARIETY EXPERIMENTS

Research to date indicates that neither the mum variety nor the season of the year in which the mum is grown affects the bud-opening process. Experiments with several varieties of California- and Florida-grown mums, conducted

by personnel of Market Quality Research Division, showed that these varieties opened satisfactorily after shipment (4, 5). However, further research is needed to determine whether all varieties will open satisfactorily.

### HANDLING OF OPEN AND BUD MUMS BY THE GROWER AND SHIPPER

Open and bud mums are cut in the same manner; that is, the operator proceeds along the bed and selects flowers for cutting. The decision to cut a stem (in essence, grading a bloom) is made by the worker as he moves along the bed. The three most important factors that the worker considers are stem length, condition of leaves, and diameter of flower. Grade requirements for open flowers are (6):

Blue grade—a minimum flower diameter of  $5\frac{1}{2}$  inches and a minimum overall length of 30 inches.

Red grade—a minimum flower diameter of  $4\frac{3}{4}$  inches and a minimum overall length of 30 inches.

Green grade—a minimum flower diameter of 4 inches and a minimum overall length of 24 inches.

In the cutting process, flowers showing an abnormality, like disease or insect damage, are culled. Buds are cut from the growing bed when the bloom has opened to a diameter of 2 to  $2\frac{1}{2}$  inches. A bud of the recommended diameter for cutting is shown in figure 1.

Leaves are stripped from the lower half of the flower stem immediately after the mum is cut from the root. Stripping of the leaves saves the cost of handling and transporting them because they are not considered a salable part of the flower. If these leaves are not removed before shipment, they have to be removed by the ultimate receiver (the retail florist, in most instances) before he offers the open flowers for sale or places the buds in opening solution.

It was not practical to measure and record the flower size that each bud attained after it was placed in preservative and opened to full bloom at destination. However, a study was conducted at a grower's nursery to measure and compare the size of blooms developed from buds with the size reached by blooms left in the bed. For this study, one lot consisting of 100



Figure 1.—Bud size as cut at the grower's facility.

buds of 2- to  $2\frac{1}{2}$ -inch diameter was cut. The buds were graded by stem length into blue, red, and green grades, and then placed in preservative. Another lot consisting of 100 buds 2 to  $2\frac{1}{2}$  inches in diameter was then selected, marked, and left in the growing bed to attain full size.

The two lots were measured for flower diameter by the researchers at the end of 48, 72, 96, 120, and 144 hours. On the average, the buds in solution attained a size as great as or greater than the size attained by the blooms marked in the growing plot at the stated time intervals. The buds in both lots attained, or exceeded, the minimum flower diameters required for their respective stem lengths. Marousky (4) obtained similar results with standard mums under laboratory conditions.

The grower or shipper normally places open mums in water overnight for freshening before they are boxed for shipment. They are,

therefore, shipped in "wet" condition. Bud mums are stored, packed, and shipped dry. During some seasons of the year, ordinary ice or dry ice is used in the shipping box for buds and open flowers. Buds are held in a cooler at 33° to 40° F. until time for the packing operation to begin.

Rolled and flat newsprint is used in the packing box to protect the open mum blooms. A roll of newsprint placed immediately below the flower head supports the mum stem and helps keep the flower head from being crushed. Other packing materials in use are wax paper, wood cleats, and twine.

## HANDLING OF OPEN AND BUD MUMS BY THE RETAILER

After open mums arrive at destination, the retailer places them in tap water for 4 or 5 hours to freshen before sale. He then places some mums in the sales area, uses others for arrangement work, and stores the remainder in a cooler at 33° to 40° F.

After mum buds are received at destination, the retailer either opens the buds immediately or places them in refrigerated storage for as long as 2 weeks before opening them. When stored under refrigeration, buds are kept "dry," usually in the same box in which they are received. The temperature of the refrigerated room should be 33° to 40° F., preferably at the lower end of the range.

The following steps are used to open buds to full bloom at destination:

1. *Mixing the solution.* Mix 1½ ounces of Smither's solution<sup>3</sup> per gallon of lukewarm (100° to 110° F.) water and stir thoroughly. Make about 1 gallon of solution per 36 flowers to be opened. *Caution:* Use only plastic, ceramic, or glass containers in which to mix or keep the solution. Metal containers may corrode and have an adverse effect upon the opening solution.

2. *Placing solution in vases.* Pour opening solution from the master container into glass, ceramic, or plastic vases to a depth of about 5 inches. The height of the vase to be used will depend upon the stem length of the mums. For

blue grade and red grade mums, the vase should be about 27 inches high; for green grade mums, about 21 inches high.

3. *Clipping stem ends.* Clip at least ½ to 1 inch from the bottom of stems with either a hand- or mechanical-type cutter to provide a freshly cut surface for uptake of opening solution.

4. *Placing in solution.* Place about 36 buds in each vase. The number of buds in a vase should be increased or decreased as required to allow sufficient space between buds for expansion to full bloom.

5. *Allowing buds to open.* Place vases of buds in a holding room at 70° to 75° F. until buds are fully open. It generally takes about 6 days for 2- to 2½-inch diameter buds to open to normal marketable size.

6. *Placing flowers in storage.* After buds are open, place the flowers in 33° to 40° F. refrigerated storage until they are needed. Flowers can either be held in storage in the same vases and opening solution, in which event they will continue to grow in size, or be transferred to vases containing ordinary water, a practice which economizes on the use of opening solution. For maximum vase life, however, mums should be held in a floral preservative.

After the opened flowers are removed from the opening solution, the operator should collect the unused solution in a plastic, ceramic, or glass container for any needed reuse. After 2 weeks, the solution should be discarded because it loses its strength. With experience, the operator can judge reasonably well the amount of solution needed to open a given quantity of buds.

<sup>3</sup> To keep the number of variables in the opening process to a minimum, the same opening material (Smither's) was used by all retailers. Several commercial preservatives were found to be effective for opening the flower buds (4, 5). When using other opening materials, one should use the proportions of the mix recommended by the manufacturer.



## COSTS AND POSSIBLE SAVINGS

Comparisons of the costs of handling and transporting open and bud mums in the California and Florida studies are shown below.

### Grower and Shipper Costs

Average grower and shipper labor and box costs at facility per 1,000 open and bud mums shipped from California and Florida are presented in table 2. Total savings for cutting and grading, carrying to the center aisle, transporting to packing shed, packing, and boxes were \$5.56 for California buds and \$4.58 for Florida buds.

There were no inherent differences between the respective cutting and grading, carrying, and transport costs in the two nurseries studied; therefore, these costs have been averaged. The data for packing and for boxes and materials for California and Florida are not averaged because different box sizes were used in the two States.

Cutting and grading costs were higher for the buds than for the opens. The costs may have

Table 2.—Average grower and shipper labor and box costs at facility per 1,000 open and bud chrysanthemums shipped from California and Florida<sup>1</sup>

Cost element	Cali- fornia opens	Florida opens	Cali- fornia buds	Florida buds
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Cutting and grading <sup>2</sup> . . . . .	4.85	4.85	5.29	5.29
Carrying mums to center aisle . . . . .	1.01	1.01	.50	.50
Transport to packing shed <sup>3</sup> . . . . .	.96	.96	.48	.48
Packing <sup>4</sup> . . . . .	3.24	2.20	1.35	1.80
Boxes and materials <sup>5</sup> . . . . .	5.24	6.15	2.12	2.52
Total . . . . .	15.30	15.17	9.74	10.59

<sup>1</sup> Based on studies conducted at 1 nursery in California and 1 in Florida.

<sup>2</sup> Includes stripping of leaves from bottom half of stem.

<sup>3</sup> An average of 263 buds can be carried per trip between growing area and packing shed, as compared with 114 open flowers.

<sup>4</sup> Based upon the average number of blue grade open mums (138) and 2- to 2½-inch buds (340) that can be packed in the 2 California (4-foot and 5-foot) boxes used in the study; and 96 opens and 234 buds that can be packed in the Florida United Parcel Service (UPS) box used in the study.

<sup>5</sup> An average of costs for the 2 California (4-foot and 5-foot) boxes, and the cost for the Florida UPS box.

been higher because the cutters were inexperienced at cutting and grading buds, with the result that it took more time. However, more buds than open flowers can be carried per trip between the growing area and the packing shed; therefore, the time and cost to transport a given number of flowers in the bud stage from the field to the shed will be less.

More buds than open flowers can be packed in a shipping container; therefore, the cost for packing labor and for packaging material for the buds is less per 1,000 flowers. In addition, the packed weight of a given number of buds is less than the packed weight for the same number of open flowers. The lower packed weight of the buds results from three factors: (1) Buds are cut at an earlier stage of development than open flowers and, thus, do not take up as much body weight from the soil; (2) buds are shipped dry and, therefore, are lighter in weight than open flowers that are placed in water for freshening before shipment; and (3) buds require fewer boxes for the shipment of a given number of flowers.

The study showed that Florida mum bud shipments had an average density of about 8.3 pounds per cubic foot (234 buds per box), as compared with an average density of about 5.5 pounds per cubic foot (96 opens) as normally shipped. Even higher densities may be possible. In one air shipment from Florida in a United Parcel Service (UPS) corrugated cardboard container (45 by 18 by 10 inches), 300 buds were packed, at a density of 10.4 pounds per cubic foot, with no detrimental effect to the flowers. Thus, with bud shipments it is possible to attain, or exceed, the minimum density of 6.5 pounds per cubic foot (1 pound per 266 cubic inches) specified by airline tariffs for cut floral products.

### Transport Costs of California Mums

Of the California mums covered by this report, over 80 percent are transported out of State by air; therefore, trucking costs were not gathered. Air transport charges are shown in table 3. The table shows the charges for transporting the flowers from the shipper's facility to the airport, air transport charges, and local trucking charges from airport to retailer.

Table 3.—Comparison of transport charges per 1,000 open and bud chrysanthemums shipped from San Francisco to eastern destinations

Condition of chrysanthemums	Box length	Local trucking charges—shipper to airport		Air transport charges		Local trucking charges—airport to retailer		Total cost per 1,000 flowers
		Per box <sup>1</sup>	Per 1,000 flowers <sup>2</sup>	Per 100 pounds <sup>3</sup>	Per 1,000 flowers <sup>4</sup>	Per box <sup>5</sup>	Per 1,000 flowers <sup>2</sup>	
	<i>Feet</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Open .....	4	1.75	14.00	20.31	48.74	2.00	16.00	78.74
	5	1.75	11.67	20.31	50.17	2.00	13.34	75.18
Average .....	—	1.75	12.84	20.31	49.46	2.00	14.67	76.97
Bud .....	4	1.75	5.48	20.31	33.71	2.00	6.26	45.45
	5	1.75	4.87	20.31	37.17	2.00	5.56	47.60
Average .....	—	1.75	5.18	20.31	35.44	2.00	5.91	46.53

<sup>1</sup> Charges in San Francisco as of November 14, 1970.

<sup>2</sup> Based upon flower holding capacities per packed box—125 opens for 4-foot box, 150 opens for 5-foot box, 320 buds for 4-foot box, and 360 buds for 5-foot box.

<sup>3</sup> Average of air freight rates per 100 pounds as of February 10, 1971, from San Francisco, Calif. to Cedar Rapids, Iowa (\$16.15); Minneapolis, Minn. (\$19.60); New York, N.Y.

(\$23.15); Pittsburgh, Pa. (\$20.55); and Washington, D.C. (\$22.10). Average = \$20.31.

<sup>4</sup> Based upon average freight rate of \$20.31 per 100 pounds and packed weights per 1,000 flowers (240 and 247 pounds for opens for the 4-foot and 5-foot box, respectively; and 166 and 183 pounds for buds for the 4-foot and 5-foot box, respectively).

<sup>5</sup> Average of charge in the 5 cities listed in footnote 3.

Total transport costs were \$46.53 per thousand for the buds and \$76.97 for the opens. The difference of \$30.44 in favor of buds is obtained because fewer boxes are needed to pack 1,000 buds and the shipping weight for 1,000 buds is less.

### Transport Costs of Florida Mums

Of the Florida mums covered by this report, about 65 percent are transported out of State by truck and about 30 percent by air. The remainder are marketed locally.

### Truck

Truck shipments are made primarily to markets on the east coast. Table 4 shows the average trucking charges from Tampa, Fla., to five of the principal cities to which Florida shipments are made. Based upon shipments to these five cities, savings in favor of buds would be \$33.40 per 1,000 mums (\$56.59 minus \$23.19).

### Air

A significant percentage of Florida mums are transported to market by air. Table 5 shows

Table 4.—Comparison of transport charges per 1,000 open and bud chrysanthemums shipped from Tampa, Fla. to east coast destinations

Condition of chrysanthemums	Box length <sup>1</sup>	Over-the-road truck transport charges		Local trucking charges—wholesaler to retailer		Total cost per 1,000 flowers
		Per box <sup>2</sup>	Per 1,000 flowers <sup>3</sup>	Per box <sup>4</sup>	Per 1,000 flowers <sup>5</sup>	
	<i>Inches</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Open .....	45	4.18	43.56	1.25	13.03	56.59
Bud .....	45	4.18	17.85	1.25	5.34	23.19

<sup>1</sup> Standard United Parcel Service (UPS) length.

<sup>2</sup> Average charge as of December 9, 1970, from Tampa, Fla., to Washington, D.C., Baltimore, Md., Philadelphia, Pa., and New York, N.Y. (\$4.10 each), and Boston, Mass. (\$4.50) = \$4.18.

<sup>3</sup> Based upon the flower holding capacity per UPS box—96

open mums or 234 buds.

<sup>4</sup> Average of charges in the 5 destination cities listed in footnote 2.

<sup>5</sup> Based upon trucking charges of \$1.25 per box and the holding capacity per box shown in footnote 3.



Table 5.—Comparison of transport charges per 1,000 open and bud chrysanthemums shipped from Tampa, Fla. to midwestern and eastern destinations

Condition of chrysanthemums	Box length <sup>1</sup>	Local trucking charges—shipper to airport		Air transport charges		Local trucking charges—airport to retailer		Total cost per 1,000 flowers
		Per box <sup>2</sup>	Per 1,000 flowers <sup>3</sup>	Per 100 pounds <sup>4</sup>	Per 1,000 pounds <sup>5</sup>	Per box <sup>6</sup>	Per 1,000 flowers <sup>3</sup>	
	<i>Inches</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Open .....	45	1.75	18.24	10.82	29.32	2.00	20.84	68.40
Bud .....	45	1.75	7.47	10.82	18.18	2.00	8.54	34.19

<sup>1</sup> Standard United Parcel Service (UPS) length.

<sup>2</sup> Charges in Tampa, Fla., as of December 9, 1970.

<sup>3</sup> Based upon flower holding capacities per packed box—96 opens per UPS box and 234 buds per UPS box.

<sup>4</sup> Average of air freight rates per 100 pounds as of February 10, 1971, from Tampa, Fla., to Boston, Mass. (\$9.85); New York, N.Y., (\$9.05); Kansas City, Mo. (\$14.30);

Chicago, Ill. (\$10.45); and St. Louis, Mo. (\$10.45) = \$10.82.

<sup>5</sup> Based upon average freight rate of \$10.82 per 100 pounds and packed weights per 1,000 flowers (271 pounds for opens and 168 pounds for buds).

<sup>6</sup> Average of charges in the 5 destination cities listed in footnote 4.

a comparison of transport charges when shipping open flowers and buds by air. Total transport costs were \$34.19 per thousand for the buds and \$68.40 for the opens. The difference of \$34.21 in favor of buds is obtained because fewer boxes are needed to pack 1,000 buds and the shipping weight for 1,000 buds is less.

### Retailer Costs

The retailer's cost to handle 1,000 buds or open mums is shown in table 6. The cost to handle buds was \$14.30; and to handle opens, \$7.35—a difference of \$6.95.

#### Opens

1. *Labor to unpack box.* The estimated cost of \$0.67 to unpack the boxes in which the flowers are received is based upon the following calculations:

Table 6.—Retailer's labor, material, and space costs to handle 1,000 open or bud chrysanthemums

Cost element	Opens	Buds
	<i>Dollars</i>	<i>Dollars</i>
Labor to unpack box .....	0.67	0.27
Labor to prepare opens or buds .....	2.13	3.60
Opening solution .....	---	2.60
Opening room space .....	---	.94
Refrigerated storage space prior to opening .....	---	2.34
Refrigerated storage space prior to sale .....	4.55	4.55
Total .....	7.35	14.30

The average number of boxes needed per 1,000 open flowers is 8.36, based upon 124 flowers per box. Time studies showed that it took 3.0 man-minutes to (1) obtain a box, (2) remove the box lid, (3) remove the flowers and position them on a shelf, and (4) dispose of the empty box. Using a labor cost of \$1.60 per hour, the cost would be  $(3 \div 60)(\$1.60)(8.36) = \$0.67$ .

2. *Labor to prepare open mums.* The estimated cost of \$2.13 to prepare the open mums for sale is based upon the following calculations:

The operations involved in preparing 1,000 opens for sale require 80 man-minutes. Using a labor cost of \$1.60 per hour, the cost would be  $(80 \div 60)(\$1.60) = \$2.13$  per 1,000 open mums.

3. *Refrigerated storage space prior to sale.* The estimated cost of \$4.55 per 1,000 opens for refrigerated space in which to store the flowers prior to sale is based upon the following calculations:

- Blooms in vases will occupy approximately 72 cubic feet per 1,000 blooms. Allowing 100 percent extra floor space for aisles and other space needs, the floor space required would be  $(72)(2) = 144$  cubic feet per 1,000 opens.
- A 91-cubic-foot refrigerator costs approximately \$350 per year to own and operate, or  $\$350 \div 91 = \$3.85$  per cubic foot per year. Assuming the mums stay in the refrigerator an average of 3 days prior to sale, the



cost would be  $(3 \div 365)(144)(\$3.85) = \$4.55$  per 1,000 opens.

## Buds

1. *Labor to unpack boxes.* The estimated cost of \$0.27 to unpack the boxes in which the flowers are received is based upon the following calculations:

The average number of boxes needed per 1,000 buds is 3.39, based upon 305 buds per box. Time studies of the box opening operation showed that it took 3.0 man-minutes to (1) obtain a box, (2) remove the box lid, (3) remove the buds and position them on a shelf, and (4) dispose of the empty box. Using a labor cost of \$1.60 per hour, the cost would be  $(3 \div 60)(\$1.60)(3.39) = \$0.27$ .

2. *Labor to prepare buds for opening.* Time studies were made at one retail facility of the operations performed to prepare buds for opening that are not required when flowers are received already open. These additional operations required a total of 135 man-minutes per 1,000 buds. Using a labor cost of \$1.60 per hour, the cost would be  $(135 \div 60)(\$1.60) = \$3.60$  per 1,000 buds.

3. *Opening solution.* Records kept at one of the retail receiver's facilities in this study indicate that about 27.2 gallons of opening solution is consumed, including wastage, for every 1,000 buds opened to full bloom. The opening material required, at 1.5 ounces per gallon, is  $(27.2)(1.5) \div 16 = 2.6$  pounds. Using a cost of \$1.00 per pound for opening material, the cost would be  $(2.6)(\$1.00) = \$2.60$  per 1,000 buds.

4. *Opening room space.* The estimated cost of \$0.94 per 1,000 buds for opening room space is based upon the following calculations:

- a. Buds in vases, allowing ample space for buds to open to full bloom, will occupy approximately 100 cubic feet per 1,000 buds. If vases are placed on the floor and on one shelf above the floor, with 42 inches from floor to shelf and 42 inches from the shelf to top of chrysanthemums on the shelf (7 feet from floor to top of flowers on the shelf), the floor space will occupy  $100 \div 7 = 14.3$  square feet. Allowing 100 percent extra floor

space for aisles and other space needs, the floor space required will be  $(14.3)(2) = 28.6$  square feet per 1,000 buds.

- b. Using a value of \$2.00 per square foot per year as the amortized cost of a one-story dry storage facility, and 6 days for buds to open to full bloom, the cost would be  $(6 \div 365)(28.6)(\$2.00) = \$0.94$  per 1,000 buds.

5. *Refrigerated storage space before opening.* The estimated cost of \$2.34 per 1,000 buds for 1 week is based upon the following calculations:

- a. The average box holds 305 buds and occupies 6.43 cubic feet. One thousand buds would occupy space calculated as follows:  $(1,000 \div 305)(6.43) = 21.08$  cubic feet. Allowing 50 percent more space for aisles and other space needs, the space required is  $(21.08)(1.5) = 31.62$  cubic feet.
- b. Because a 91-cubic-foot refrigerator costs approximately \$3.85 per cubic foot per year to own and operate, the same as was calculated for opens, the cost for the bud storage would be  $(31.62)(\$3.85) \div 52 = \$2.34$  per 1,000 buds per week.

6. *Refrigerated storage space before sale.* The refrigerated storage space required before sale, and its cost, are the same as previously given for opens.

## Total Savings Possible

Total savings on a volume of 67 million standard mums shipped as buds out of California and Florida in 1969 would be about \$1.9 million.

The estimated total costs and savings per 1,000 open and bud mums transported by air from California are shown in table 7. The table shows that if mums were handled and transported by air in the bud instead of the open stage, the estimated total savings would be \$29.05 per 1,000 mums.

Of the 70.7 million standard mums produced in California in 1969, about 57 million (80 percent) were shipped out of State by air. If that quantity were handled as buds, savings in

Table 7.—Estimated total costs and savings per 1,000 open and bud chrysanthemums transported by air from California to midwestern and eastern destinations

Phase in distribution process	Costs		Savings
	Opens	Buds	
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Grower and shipper (at facility) <sup>1</sup> . . . . .	15.30	9.74	5.56
Transport charges <sup>2</sup> . . . . .	76.97	46.53	30.44
Retailer (at facility) <sup>3</sup> . . . . .	7.35	14.30	<sup>4</sup> +6.95
Total . . . . .	99.62	70.57	29.05

<sup>1</sup> See total costs, table 2.

<sup>3</sup> See total costs, table 6.

<sup>2</sup> See total charges, table 3.

<sup>4</sup> Cost increase.

marketing costs would be approximately \$1.65 million.

The estimated total costs and savings per 1,000 open and bud mums transported by truck from Florida are shown in table 8. The table

Table 8.—Estimated total costs and savings per 1,000 open and bud chrysanthemums transported by truck from Florida to eastern destinations

Phase in distribution process	Costs		Savings
	Opens	Buds	
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Grower and shipper (at facility) <sup>1</sup> . . . . .	15.17	10.59	4.58
Transport charges <sup>2</sup> . . . . .	56.59	23.19	33.40
Retailer (at facility) <sup>3</sup> . . . . .	7.35	14.30	<sup>4</sup> +6.95
Total . . . . .	79.11	48.08	31.03

<sup>1</sup> See total costs, table 2.

<sup>3</sup> See total costs, table 6.

<sup>2</sup> See total charges, table 4.

<sup>4</sup> Cost increase.

shows that if mums were handled and transported by truck in the bud instead of the open stage, the estimated total savings would be \$31.03 per 1,000 mums.

The estimated total costs and savings per 1,000 open and bud mums transported by air from Florida are shown in table 9. The table shows that if mums were handled and transported by air in the bud instead of the open stage, the total estimated savings would be \$31.84 per 1,000 mums.

Table 9.—Estimated total costs and savings per 1,000 open and bud chrysanthemums transported by air from Florida to midwestern and eastern destinations

Phase in distribution process	Costs		Savings
	Opens	Buds	
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Grower and shipper (at facility) <sup>1</sup> . . . . .	15.17	10.59	4.58
Transport charges <sup>2</sup> . . . . .	68.40	34.19	34.21
Retailer (at facility) <sup>3</sup> . . . . .	7.35	14.30	<sup>4</sup> +6.95
Total . . . . .	90.92	59.08	31.84

<sup>1</sup> See total costs, table 2.

<sup>3</sup> See total costs, table 6.

<sup>2</sup> See total charges, table 5.

<sup>4</sup> Cost increase.

Of the 10 million mums produced in Florida in 1969, about 6.5 million (65 percent) were shipped by truck. If that quantity were marketed as buds, savings in handling and transport costs would be approximately \$202,000. About 3 million flowers (30 percent) are transported out of Florida by air. That quantity, handled as buds, would save approximately \$95,000.

## OTHER POSSIBLE ADVANTAGES

Buds do not snag as easily as open flowers because the florets of the flower are not opened and so are not exposed to damage from bruising, shearing off, or breaking against objects during the cutting, carrying, and packing operations. Therefore, breakage, with resulting downgrading of flower quality, probably would be less for buds than for open flowers. For example, records kept at the retailers during the study showed an average of five open flowers broken per 100 received. In comparison, only two buds were broken per 100 received.

At the grower's facility, open flowers are normally held in refrigerated storage in buckets of water. Buds, on the other hand, are held in fiberboard boxes. Although no measurements were made, it was noted that a given quantity of buds required less storage space than open flowers. Likewise, at the wholesale facility at destination, buds occupied less space than open flowers because more buds than opens were contained in a shipping box.

The shelf life of the bud-cut flowers begins after the flowers are transported to their ulti-



mate destination and have been opened in preservative. With opens as currently shipped, some of the shelf life of the bloom is lost in transport.

By harvesting mums in the bud stage, growers should be able to increase the number of mums grown per plot per year because the bed is cleared earlier with the earlier cutting of the mums. The ground can then be worked and made ready for fresh planting in a shorter time than is possible when the mums are not cut until they are open blooms.

By handling buds, supply and demand

should be leveled somewhat because dry buds can be stored longer than open flowers. Therefore, it may be possible to store buds in anticipation of peak demands at the shipper's or retailer's facility.

Because buds can be stored for as long as 2 weeks, the placing of orders and shipments can be made less frequently, with larger quantities ordered and shipped. The result should be that less time and labor will be needed for billings, telephone conversations, orders, and other factors associated with marketing flowers.

## DISADVANTAGES

Additional costs are incurred at the retailer's facility for refrigerated storage space for buds before opening, and for the material, labor, and room space required to open buds to

full bloom. Also, sale of the flowers is delayed because the buds must be opened before they are ready for sale.

## CONCLUSIONS

Growers, shippers, retailers, and others involved in physical distribution of flowers could realize substantial benefits from handling mums in the bud stage instead of as open blooms.

The functioning of mum bud marketing requires varying degrees of effort by the grower, shipper, and retailer. The greatest effort is required by the retailer because the bud-opening

operation occurs in his facility.

The researchers encountered no major problems in the handling of mums in the bud stage. However, growers, shippers, and retailers who try this concept commercially would be wise to do so initially on a small scale, so that if problems occur they can be corrected more easily than would be possible in a large-scale operation.

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